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Simply put the MB Crusher Bucket lets your demolition or site prep double as production of base or filler material. Pick up a bucket full of rocks with your excavator, and dump it out as gravel. Pick up gravel, and dump it as sand. Pick up reinforced concrete, and dump out recycle-ready aggregate and rebar. Not only is this convenient, but it helps eliminate costs for purchasing and transporting material for site prep, as well as making post-demolition cleanup easier and more efficient and reducing landfill waste. It's also ideal for more confined sites where a full-size portable crusher unit isn't feasible.

They accomplish this by incorporating powerful, compact crusher jaws right into a strong but lightweight bucket. The bucket gives the operator an amazing degree of control over how coarse or fine the end product will be. No more time wasted scooping and dumping unusable material into trucks and transporting them off-site to be processed. It can be processed right on

site and then put to use. In one of the most amazing examples of the product in action, a promotional video by the company shows the attachment inverted, "chewing" its way down a 30+ foot reinforced concrete pillar, spitting concrete rubble and in-tact rebar out the other end at what appeared to be a rate of between .5 foot and 1.5 foot per second. (See the video for yourself on YouTube, here: <http://bit.ly/1twonUv>).

Strength, power and technological innovation are just some of the aspects MB products embody and spread throughout the world. After innovating the single-toggle jaw crushing attachment 13 years ago, MB S.p.A has poured countless resources into continually developing, improving and testing its crusher buckets, as well as soliciting continuous feedback from the real-world use by customers. And it shows.

The company produces a range of excavator attachments that turn any

heavy excavator, mini-excavator or skid loader into a jack-of-all-trades, capable of crushing, screening and sorting rocks and rubble. MB holds numerous patents, including those for the world's largest and smallest crusher bucket.

They've worked with some of the biggest names in the industry, including Thompson CAT, Komatsu EQ, AMI Attachments and Kinross & Barrick Gold to develop the best crusher bucket the world has to offer, and today they are still trying to outdo themselves.

MB has bold goals for the next five years. They aim on opening regional offices across the U.S., giving them more reach into the market and giving customers better access to support and expertise. They also are looking at launching their own production facility to help cut costs and improve efficiency in bringing newer, better crushers to market. ■



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## Compliance- Areas Covered:

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- Policies
- Duty of Care

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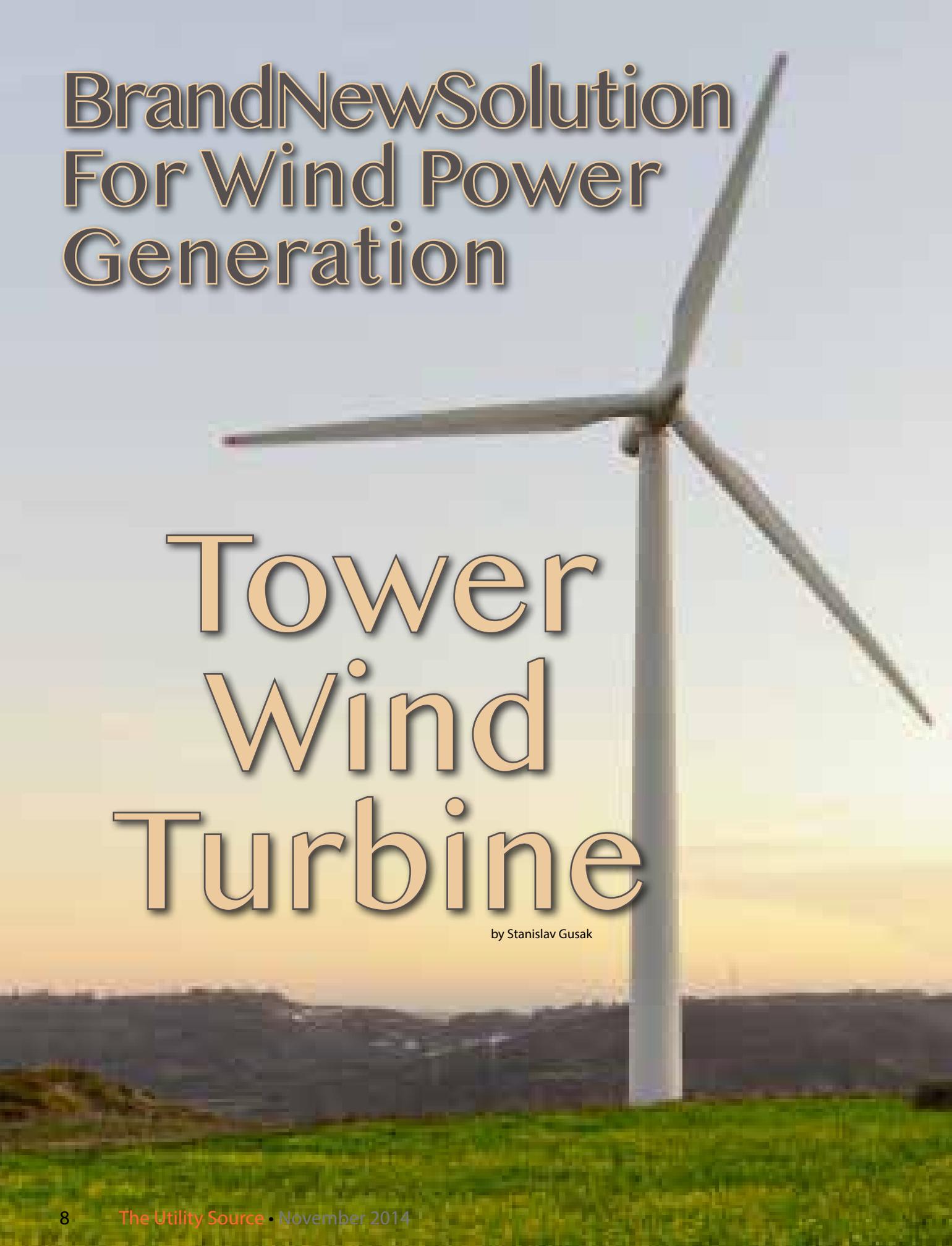
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# BrandNewSolution For Wind Power Generation

A large tower wind turbine stands in a grassy field under a sunset sky. The turbine is the central focus, with its three blades extending outwards. The background shows a horizon line with a warm, orange glow from the setting sun.

# Tower Wind Turbine

by Stanislav Gusak

# Wind Power: Yesterday, Today, Tomorrow

Historical background in brief:

People have been using wind power from the time immemorial.

Originally they learnt to transform kinetic energy of wind stream into mechanical one. There appeared lots of different wind mills making men's life much easier in those times.

An idea of a wind turbine for electric power generation using wind power started up around 100 years ago.

Inventors created wide range of various types of wind power generator designs:

- by axis (horizontal, vertical, inclined);
- by number of blades (one, two, three and more);
- by capacity (from tens W to several MW);
- by blade design, by generator design etc.

But in an attempt to raise WTG's capacity inventors faced new problems:

1. Mechanical properties of materials modern wind generators are made of become serious constraints due to the generators' size and dynamic loads they bear. Further expanding capacity (size) of wind generators calls for application of the latest which means more expensive materials which is reflected on the rise of prices of generated power that are rather high even without that.

2. Wind generators of higher capacity require higher wind speeds. Nowadays it becomes more and more difficult to find areas for construction of wind farms but people require more and more power.

Today wind energy market grows up to 30% annually. But with wind power generation enthusiasts along there lately appear more and more skeptics. Wind power generation being clean and using renewable sources has number of substantial disadvantages: low quality of generated power, TV and radio signals interference, bad sound influence on fauna and need in additional reserve power generating capacities of traditional design etc.

More and more people being worried about negative trends in wind energy generation reasonably ask such questions as: What are the prospects of wind power generation? Will wind power generation take economically significant place in world economy? Will the investments in wind power generation be fruitful etc.?

World oil and gas market situation stimulates development of power generation using renewable sources. High price and low quality of such electric power does not make estimates of wind energy generation prospects more optimistic.

People need new reliable sources of electric power meeting following requirements of today's life:

1. Low price of generated power
2. High quality of generated power
3. Power output should satisfy constantly growing demand
4. Clean power generation

One of the alternative power generation solutions meeting most of the requirements mentioned above is presented below.

Everything new is long forgotten old

Wind energy generation is fundamentally based on two elements: energy source (wind) and energy receiver (wind turbine generator).

Since first steps in wind power development and until now inventors have been improving energy receiver but energy source (wind) has been considered to be a gift of nature that is beyond any control.

In many ways it reflected in various disadvantages of modern wind power generation.

In technical system "wind – wind generator" both elements are equally important. Only control over all elements of a system allows reaching highest working efficiency. Improving energy receiver they dropped an idea of controlling wind for no need. But in vain!

Level of modern technical development allows arrangement of quite an effective control over such systems.

But wind power generation went the other way. At present all wind generators operate on the basis of the same principal: collecting energy of incoming air flow.

We decided to develop a brand new technical system which could allow controlling both energy source as well as energy receiver. Using men's experience and knowledge in construction and operation of wind generators we can sufficiently increase their working efficiency by controlling of air flow

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The hydraulic operated four-corner tail design features a diamond plate metal approach with wood frame weld in location. Spare pockets and 15 escaping parking screws are standard equipment.

Driver's side controls make it easy to operate the functions. All lights on the trailer are long-lasting LEDs and the trailer is finished with two-component, chemically-resistant, anti-rust primer and top coat.

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parameters (energy source).

One of the results of our long year researches and tests is a tower wind turbine. It gives a possibility more or less to control all the elements of the system "wind – wind generator".

Tower wind turbine consists of the following main elements: energy collecting device, generator, energy concentration device and control system.

Energy collecting device is designed as a vertical cylinder the walls of which are framed of profiles making end-to-end channels connecting outer side of the cylinder with its inner vertical channel (input convergent channels). Their aim is to "catch" incoming air flow and turn it vertically up along the vertical axis of the unit and to send it to generator blades.

Generator with blades is placed inside the energy concentrating apparatus. Generator transforms kinetic energy of wind into electrical one.

Energy concentrating device is contractually designed as a vertical hollow tower inside dimensions of which converge in the central part where the generator is placed. Inner part of the tower is continuation of the vertical inner channel of the energy collecting device. Such design allows concentration of kinetic energy of wind on generator blades.

Control system (is not shown in the picture) provides timely opening of convergent channels of the tower from the side of the incoming wind and closing of all the other convergent channels.

What are principal differences between tower wind turbine and conventional wind generators, transforming energy of incoming air flow?

1. It allows controlling wind energy concentrating on generator blades.
2. Rotor blades do not need to be "tuned" to wind. Vertical axis generator is fixed in the upper part of the unit. Wind is "tuned" to the generator itself owing to design of the energy collecting device.
3. Speed of wind rises significantly when it reaches generator blades. Design of the energy concentrating device allows raising wind speed in the inner vertical channel of the unit increasing its capacity accordingly.

Experimental tests of the unit models in aerodynamic tunnel showed growth of power output of the generator placed inside the tower more than 4 times, and at low wind speeds – more than 10 times.

To prove received results a 100:1 scale production prototype was constructed. Diagram of comparative tests is similar to laboratory tests diagram.

Analysis of received results shows significant efficiency growth of the generator placed inside the concentrating tower in comparison with wind generators of conventional design:

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- Area of allotted land per unit of rated capacity of the TWT is the lowest among all types of generation.

Tower wind turbine concentrates wind energy on generator blades like a lens collecting sun light into the focus.

Design features of the TWT allow elimination of various disadvantages of conventional wind generators:

1. Noises and radiation harmful for people that can appear during operation of the generator of the TWT do not leave the tower as generator and blades are placed inside of it. Modern materials allow reduction and absorption of harmful noises and vibrations. For the same reason generator and blades of the TWT do not interfere TV and radio signals.

2. TWT can not cause any injuries for birds. To prevent birds from getting onto generator blades one may place protective nets at the entry to the convergent channels. To avoid birds clashing into the TWT at night its outer surface is lighted. It

could also improve tower's appearance.

#### Future Outlook

Technical characteristics of the TWT surpass all the modern convention wind turbine generators using incoming air flow.

Tower wind turbine can be a worthy substitute for conventional wind turbine generators:

- TWT can work at low wind speeds.
- TWT allows reaching larger power output.
- TWT's effectiveness is in no way lower than that of conventional power stations using carbon fuel such as: gas, coal, black and crude oil and its ecological cleanness has no analogues.
- TWT becomes very effective in areas with low wind speeds.
- Area of allotted land per unit of rated capacity of the TWT is the lowest among all types of generation
- Due to its compactness TWT can become an autonomous self-sufficient power source.

Tower wind turbines today are world wind power generation of tomorrow: low production cost and high quality of ecologically clean energy.

Stanislav Gusak Director of the R&D Enterprise ENERIS ■

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# Contractor Metro Express, Inc. installs manhole within feet of adjacent building with Efficiency Production's Slide Rail System

[By James McRay]

South Beach Florida is all about "sexy." However, one recent underground infrastructure project could hardly be called that, yet was extremely important in keeping Miami's most popular beach area up to grade below the ground. Metro Express Inc.—headquartered in Medley, Florida—was recently tapped by the City of Miami to upgrade and install new drainage and water main connections, as part of the City's Neighborhood #9-City Center Road Way Improvements project.

Any excavation project in a busy urban area poses many challenges for contractors, not the least of which is keeping workers safe when they are working in a pit or trench. That normally requires a contractor to use a trench protection system such as sloping, trench shielding, or shoring. However, when digging in a tight congested space like South Beach, it may not be possible to use traditional trench protection techniques and practices. The many surrounding buildings, structures, and other underground crossing utilities make it impossible to open-cut a trench for either sloping or using a trench shield.

Metro faced this dilemma when installing a new manhole and sewer tie-in at the corner of Liberty and 20<sup>th</sup> Avenues. The trench needed to be dug mere feet from an adjacent business' patio. Therefore it was critical the structure not be undermined or compromised by the excavation in any way. In other words, trench boxes or sloping were not going to work.

## Non-traditional shoring system required

The first thing Metro's Project Manager did to find a solution to this challenge was call a local shoring equipment rental company for assistance; in this case, Efficiency Shoring & Supply's

FRONT COVER: Medley, Florida, contractor Metro Express, Inc. performs a tricky manhole installation in close proximity to a downtown Miami South Beach business.

Metro is able to successfully shore the trench for the manhole install mere feet from the business' patio by utilizing an Efficiency Production, Inc. manufactured Slide Rail System.



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Miami Branch Office. This turned out to be a good decision as Efficiency Shoring & Supply is an official factory-direct distributor of manufacturer Efficiency Production, Inc. who had the resources and expertise to find a solution to Metro's challenges.

Working directly with Metro Express, the Shoring Specialists in Efficiency Production's Special Operations Shoring Division were able to design a 4 feet wide, 38 feet long and 6 feet deep Slid Rail System that would work to tightly shore—a mere three feet in this case—the trench next to the patio and not undermine the adjacent structure in any manner.

Efficiency's Universal Slide Rail is a component shoring system comprised of steel panels (similar to trench shield sidewalls) and vertical steel posts. The highly versatile system can be used in a variety of configurations. Efficiency's Slide Rail System can be configured into small four-sided pits; an obstruction-free ClearSpan™ configuration; or in a Multi-Bay™ configuration to install large tanks and structures or lengths of pipe over 40 ft.

Rental company Efficiency Shoring & Supply provides on-site assistance

The Slide Rail equipment was rented from Efficiency Shoring & Supply's Miami Branch, who's Shielding & Shoring Specialists were regularly on-site specifically to provide equipment support.

"One of the biggest advantages of Efficiency's Slide Rail System is the fact it can be installed with very limited access to the worksite," said Brian Campbell, Efficiency Shoring & Supply's Miami Branch Manager. "And the system can usually be installed with a standard sized excavator that many excavation contractors already have in their fleet; another advantage to the system."

Slide Rail is considered "positive shoring." It is installed by sliding the panels into integrated rails on the posts, and then pushing the panels and posts incrementally down to grade as the pit is dug; a process commonly referred to as a "dig and push" shoring system. "That's another advantage of our Slide Rail; there's no over-excavation," added Campbell. "The system keeps that pressure against the surrounding dirt, which was critical for Metro digging so close to that business' patio," Campbell concluded.

Efficiency Production's Special Operations Shoring Division offers installation assistance

To help install the system,

Efficiency Production sent their Senior Slide Rail Installer, Rod Austin, to assist Metro with the installation. "The Metro Express guys were great to work with; super hard working," said Austin. "It really was a tough spot to work but the Metro guys were flexible and took direction well when on-the-spot changes were needed," concluded Austin.

Metro Express had a fleet of heavy equipment at their disposal; including excavators, mini-excavators, loaders, and skid steers. The \$600,000 city improvement project was completed in August 2013. Chen Moore and Associates was the engineering firm for the project.

James McRay is the Director of Marketing & Media for Efficiency Production, Inc. Efficiency Production's Special Operations Shoring Division is staffed by the nation's most experienced team of Slide Rail experts and installers. The Division's goal is to act as an extension of a contractor's estimating department or rental operations; including: reviewing project plans and selection of shoring equipment, providing written quotation and requested submittals, providing P.E. stamped 3D submittal and proposal drawings, as well as offering pre-construction on-site consultation and special engineering. [www.efficiencyshoring.com](http://www.efficiencyshoring.com) ■

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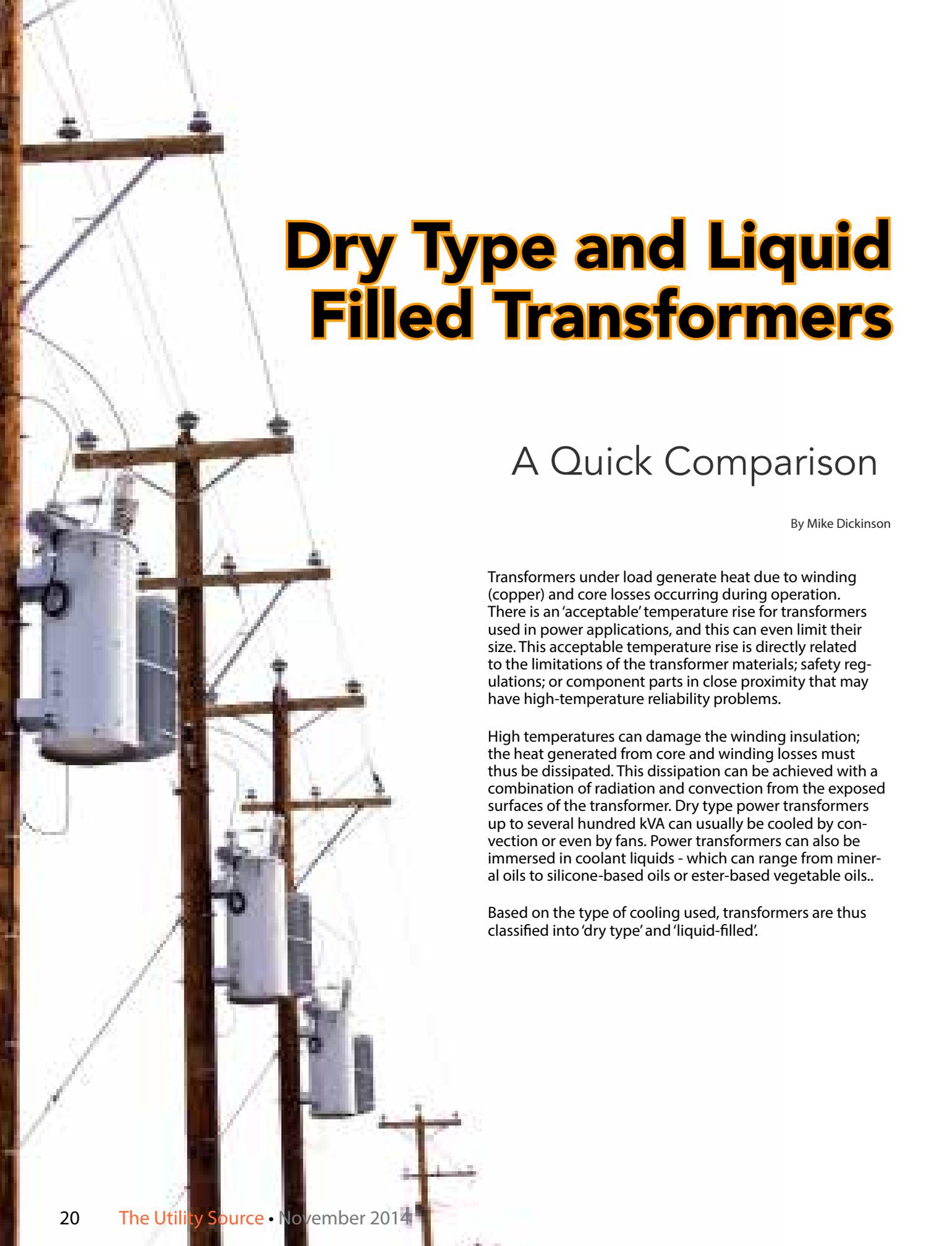
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# Dry Type and Liquid Filled Transformers

## A Quick Comparison

By Mike Dickinson

Transformers under load generate heat due to winding (copper) and core losses occurring during operation. There is an 'acceptable' temperature rise for transformers used in power applications, and this can even limit their size. This acceptable temperature rise is directly related to the limitations of the transformer materials; safety regulations; or component parts in close proximity that may have high-temperature reliability problems.

High temperatures can damage the winding insulation; the heat generated from core and winding losses must thus be dissipated. This dissipation can be achieved with a combination of radiation and convection from the exposed surfaces of the transformer. Dry type power transformers up to several hundred kVA can usually be cooled by convection or even by fans. Power transformers can also be immersed in coolant liquids - which can range from mineral oils to silicone-based oils or ester-based vegetable oils..

Based on the type of cooling used, transformers are thus classified into 'dry type' and 'liquid-filled'.

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## Liquid-Filled Transformers

- Oil-filled Transformers

Oil-filled transformers primarily use mineral-based oil and cellulose paper (Kraft or Aramid) in their insulation systems. This proven combination exhibits outstanding thermal and dielectric properties at a relatively low cost. So popular and effective are these units, that all other transformer designs are judged in relation to them. They are still unparalleled in terms of purchase cost, among all the options available. The inherent weakness of a mineral oil-filled transformer, of course, is flammability; which is why oil-filled transformers are usually restricted to outdoor installations, or indoor installations that have elaborate means of fire protection.

### Typical Applications:

Oil-filled transformers, thanks to their lower purchase costs, find applications in literally every sort of power distribution. Of late, the awareness of the fire risks associated with mineral oil-filled transformers has created a movement towards safer alternatives that use non-flammable, biodegradable liquids, or even dry-type transformers.

- Non-Flammable Liquid-Filled Transformers

Polychlorinated biphenyl (PCBs) were produced in large quantities starting as early as the 1930s, in response to the electrical industry's need for a less flammable substitute for mineral oil as a cooling/insulating fluid for transformers. Several industrial incidents, however, brought the toxicity of PCBs to the fore. As confirmed organic pollutants, PCBs were banned by the late 1970s. A number of alternatives have since surfaced - major ones being silicone, perchloroethylene, high temperature hydrocarbons, and mixtures of oil with perchloroethylene. The first high molecular-weight hydrocarbon-based fluid (HMWH), was introduced in 1975. This fluid possesses similar dielectric properties as mineral oil, provide remarkable levels of fire-resistance, and do not have undesirable environmental fallouts.

### Typical Applications:

Non-flammable liquid-filled transformers can be installed indoors and outdoors, close to buildings, walkways and rooftops. Usually, no additional infrastructure is required to address issues like fire safety.

- Biodegradable Fluid Liquid-Filled Transformers

Animal fats and vegetable oils offer substitutes that

are significantly less harmful to the environment than petroleum oils. However, vegetable oils were not used in transformers for a long time; a fluid which could be stable in the transformer environment and available in the required quantities was simply not available.

Transformer manufacturers have since worked on transformer designs that utilize vegetable oil-based dielectric fluids. Comparable in size and electrical performance to conventional liquid-filled units, these transformers are filled with the less flammable dielectric fluids mentioned above. The immediate advantages of biodegradable fluids are clear: higher fire and flash points, thus reducing flammability concerns. The other, and perhaps more long-term advantage, is the fluid's biodegradability: it has demonstrated high environmental assimilation (over 95% in less than a month) - and it has the virtue of coming from a toxin-free resource.

### Typical Applications:

Biodegradable fluid liquid-filled transformers find application in wind turbines, and other indoor and outdoor areas of heightened environmental and safety sensitivity.

### Dry Type Transformers

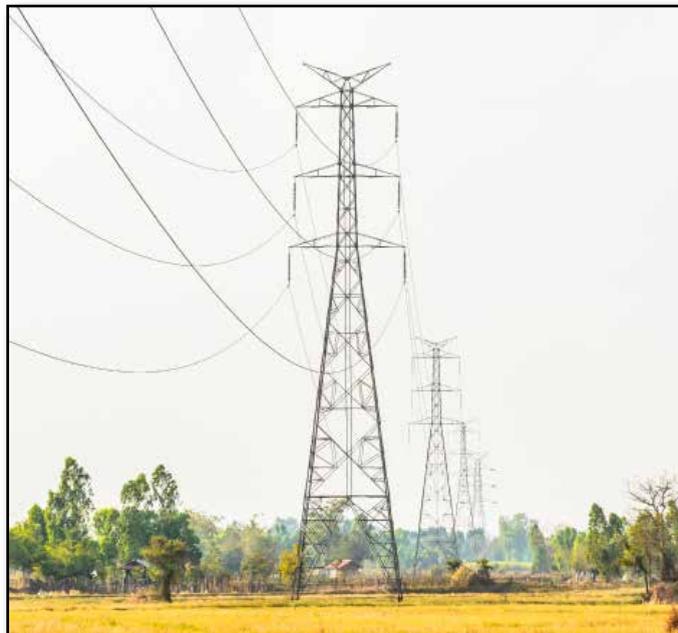
- Vacuum Pressure Impregnated (VPI) Conventional Dry Types

Dry type transformer construction uses high-temperature insulation that exceeds the ratings of cellulose or 'O' and 'K' class fluids. Modern conventional dry type transformers feature insulation systems comprising carefully coordinated high-temperature (220°C) materials coated with a high-temperature, moisture-resistant polyester sealant. On better quality premium units, the polyester sealant is typically applied with a vacuum pressure impregnation (VPI) process. Units built in this fashion have exhibited high resistance to most chemical contaminants. Dry type transformers are generally rated up to 30MVA; perfor-

mance under overload is demonstrably limited, but the addition of cooling fans can usually help augment this.

### Typical Applications:

Dry type transformers have been used effectively in diverse commercial and industrial environments for decades; at ratings exceeding 15 kVA. Appropriately designed and installed, VPI units can even be an exceptionally economical choice in medium voltage distribution (15 kVA, 10 MVA ratings), even with the inclusion of installation costs. Because





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of reduced fire risks, these transformers have been used successfully in special applications where the public are in close proximity, such as underground tunnels, residential apartments, oil rigs and more.

- Gas-Filled Dry Types

Gas-filled dry type transformers are designed for applications where low flammability is a vital consideration. N<sub>2</sub>, C<sub>2</sub>F<sub>6</sub>, and SF<sub>6</sub> gases are the ones used in these designs, providing a dielectric medium that is external to the windings. Apart from being the dielectric medium, these gases also act as the thermal medium to transfer heat from windings to tank walls. Gas-filled transformers are an alternative to dry-type construction with fewer fire and contamination risks.

Typical Applications:

Gas media have somewhat limited thermal capabilities; and gas-filled dry type transformers usually do not exceed 3750 kVA (C<sub>2</sub>F<sub>6</sub>) or even 2000 kVA (N<sub>2</sub>). Their design also makes them considerably larger than oil-filled units - anywhere from 20% to 30% bigger. Properly designed and installed gas-filled transformers can operate in any environment and remain truly non-flammable. They are commonly installed in dry-docks to provide local power for shipbuilding. Dry-docks (including transformers) are eventually flooded to float the ship away from the construction site.

- Vacuum Pressure Encapsulated (VPE) Dry Types

Military shipboard use is an exacting requirement, and VPE dry type transformers were developed to meet these needs. VPE transformers are similar to VPI transformers, but employ a resin made of silicone instead of polyester. The VPE method includes several dip processes to encapsulate the coil assembly; the coatings are then cured in an oven. The resin coating in the VPE design is also typically thicker, sometimes by as much as a factor of four; as can be expected, the thermal classification of the insulation system is markedly different for the military than for commercial applications. VPE transformers are more resistant to harsh and wet environments than VPI type counterparts.

Typical Applications:

VPE dry type transformers typically find applications in very harsh indoor and outdoor environments. VPE technology allows the transformer to be highly resistant to humid and caustic environments, but carefully designed enclosures are still a must.

- Epoxy Coated Dry Types

Epoxy coated, or 'epoxy shielded' dry type units offer the benefits of better environmental protection, minimal noise, high basic impulse levels and better short circuit strength than cast coil types. Epoxy shielded transformers are also usually less expensive, flexible, smaller and lighter. There are typically two variants of epoxy coated transformers - in one, a VPI dry-type is given an overcoat

of epoxy varnish; in the other, the epoxy varnish is used as a complete replacement for the polyester sealant.

Typical Applications:

Epoxy coated transformers can be ideally suited for environments that may be polluted with acids, alkalis and chlorides. They are also resistant to the effects of salt water and high humidity, thus finding numerous applications in areas which concentrations of these problems.

- RESIBLOC Epoxy Cast Dry Types

Unlike conventional VPI dry type designs, RESIBLOC Epoxy Cast dry type transformers do not use insulation papers in the windings. Instead, pure epoxy resin reinforced with glass fiber rovings are wound directly with the wire. Winding processes controlled by advanced electronics also ensure even distribution and high levels of precision. Aluminum/copper foils are used for the low voltage winding; and circular (or rectangular) copper conductors with glass-fiber reinforced epoxy resin insulation are used for the high voltage windings. The completed winding block is then 'cured' in a specially designed oven under rotation. This process enables cast winding production without molds or vacuum. As in most cast epoxy units, the dielectric material on the interior winding is the epoxy itself. RESIBLOC transformers are reliable, environmentally safe, offer extreme fire resistance, have high short circuit withstands, and can be exposed to extreme conditions with minimal maintenance.

Typical Applications:

RESIBLOC transformers often find applications in energization, ovens, or traction; they are commonly found in the railways, marine propulsion and distribution, in the nuclear energy and windmill power sectors, and in the mining industry.

- Epoxy Cast Dry Types

The primary and secondary coils in epoxy cast dry type transformers are usually wound with copper conductors, pre-heated and placed in a mold which will then be filled with de-gassed and mixed epoxy under vacuum. The molds are then cured in special ovens to allow sound, void-free casting. The result is a winding design that is void-free, hermetically sealed, and with a smooth exterior finish.

Typical Applications:

Epoxy cast dry type transformers are used inside buildings and tunnels, on ships, offshore platforms and cranes, food-processing plants, and more. They are often combined with primary and secondary switchgear and distribution boards, to form compact substations.

Mike Dickinson-contributing writer for Pacific crest transformers. To know more about Liquid filled distribution transformers check out Pacific crest transformers website. ■

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# Switchgear Maintenance

## The Ins and Outs

### Switchgear Maintenance - The Ins and Outs

Over the years switchgears have been made from various materials; understanding what kind you have, whether it is oil filled or air blast vacuum switchgear, maintenance is of high importance. Deciding what kind of maintenance program you will have depends on the switchgear's usage.

### Types of Switchgear Maintenance Programs

Determining how the switchgear maintenance will be conducted usually comes down to how important that portion of the grid is. It must be understood that, since switchgear is attached to the electrical grid, it is an important piece of the electric producing puzzle.

There are basically three types of switchgear maintenance programs that most areas use; constant monitoring, run to fail, and a combination of the two. Choosing the correct one can mean the difference between no problems, or a large amount of down time.

### Switchgear Maintenance - Constant Monitoring

In the constant monitoring plan for switchgear maintenance, the equipment is usually hooked to a computer system that is always giving updates on the different pieces of the machinery. There is a planned maintenance and testing schedule and this routine maintenance is carried out periodically.

The main drawback of this switchgear maintenance plan is that it is cost prohibitive, and requires someone whose sole duties are concerned with the maintenance program. This is the type of plan for switchgear connected to a very important part of the grid.

### Switchgear Maintenance - Run to Failure

Run-to-failure switchgear maintenance is the most cost-effective form of program. In this plan, no routine maintenance is done. The equipment is simply allowed to run until it needs to be repaired. While this is the least expensive option, it can only be used in an area where having to shut down part of the grid, will not have a huge impact on service.

### Switchgear Maintenance - Combination

Using a combination of the two types of switchgear maintenance



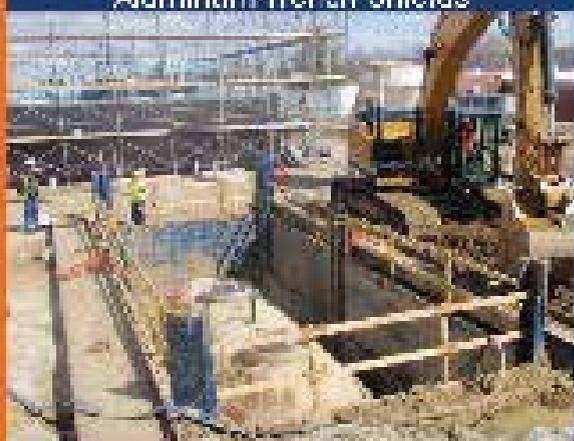
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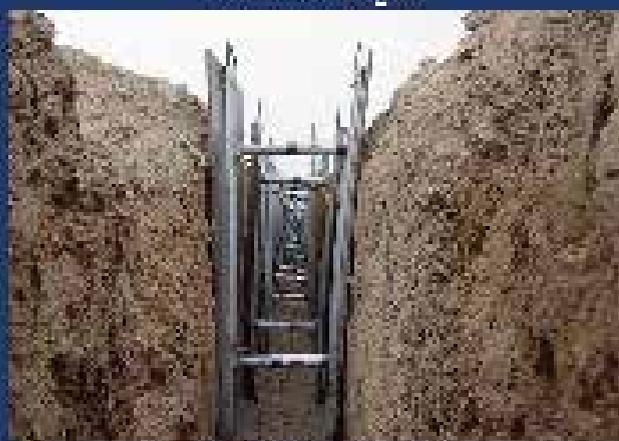
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is most common. In this maintenance plan, certain parts of the equipment such as warning lights are left to be repaired only when they stop working. Other more important parts are on a maintenance schedule and tested regularly. This plan works well when the shutdown cost of this equipment outweighs the cost of the maintenance schedule.

#### Switchgear Power Systems - Should I Choose Gas Insulated Or Air Insulated?

There are two main types of switchgear power systems: gas insulated and air insulated. There is a large debate as to which switchgear system is more effective and which is safer to use for the environment.

#### Gas-Insulated Switchgear Systems

Gas-insulated switchgear systems are quite efficient in that they require a very small amount of space and the equipment is relatively inexpensive to operate. This allows for use in areas of high population and in areas where it is more eye-pleasing to use a smaller system, such as department stores, high-rise buildings, industrial plants or mobile units.

However, with the use of the gas-insulated switchgear system also comes the emission of sulfur hexafluoride. While sulfur hexafluoride is a non-toxic, odorless and non-flammable gas, it is also what is called a greenhouse gas, which is known to be harmful to the earth's ozone layer. Many environmentalists oppose the use of these types of switchgear systems, even though this particular gas contributes to only .05% of the greenhouse gases emitted. These emissions have also been cut by about 40% since 1995 and there is always work that is being done to reduce them even further.

#### Air-Insulated Switchgear Systems

The air-insulated switchgear systems can come with a slightly higher price tag than the gas systems. They are larger and can cost more to operate, leaving little room for them in the more compact areas in which their counterparts can fit.

While these switchgear systems have been found to be more environmentally friendly (because, honestly, what could be more environmentally friendly than air?), their size and the sheer cost of operating such bulky machinery is often a deterrent to having them in smaller areas of business and residential housing, such as apartment buildings.

#### Which Switchgear System is Better for Your Needs?

When all of these things are taken into consideration, it ultimately becomes a debate on which switchgear system is able to provide people with the capabilities that are needed coupled with the environmental responsibilities that come along with the service.

Of course, while it is important to keep the greenhouse emissions as low as possible, and these environmental responsibilities belong to us all, the amounts that are released with the gas switchgear systems hardly seems to be a noticeable culprit if you look at the totals from all other sources.

#### Switchgear Maintenance - Final Thoughts

Determining the type of plan for your switchgear maintenance comes down to two considerations. Determining the importance of the part of the grid in question and balancing the cost of maintenance versus the cost of a shut down. What you choose is up to you, as long as you keep in mind that no one wants to be without power. ■

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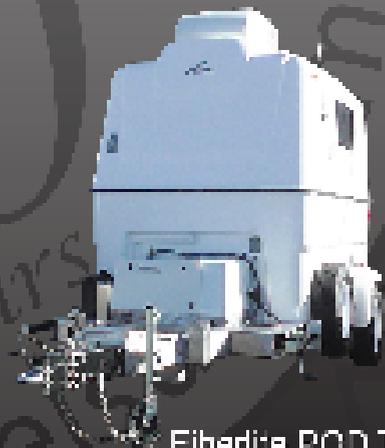
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